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(54) Glass and/or vitreous ceramic laminate system for microwave-shielding applications

(57) A composite glass-and/or vitreous ceramic-bonded system for application as shielding against microwave radiation comprises between at least one supporting plate and at least one cover plate made of glass and/or vitreous ceramic material, a metallic microwave-impermeable shield which is non-detachably adhesively bonded to said plates by means of a viscously elastic and/or permanently elastic cement, the said metallic shield being conducted out of the bonded unit in such a manner as to enable it being connected in microwave sealed fashion to an adjoining frame and/or to mounting means. The composite system may be used, for example, as a viewing or observation panel for microwave-charged chambers.

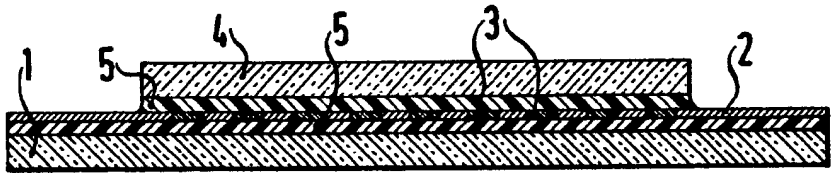

FIG. 1

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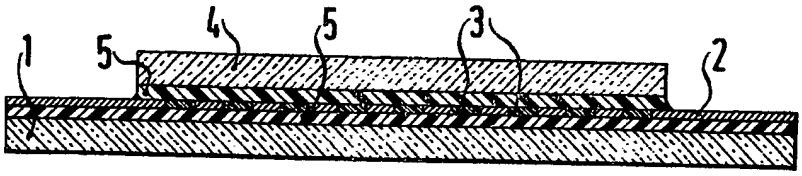


FIG. 1

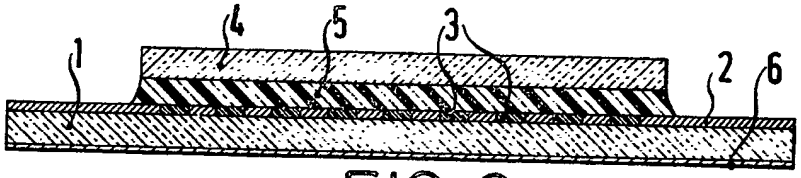


FIG. 2

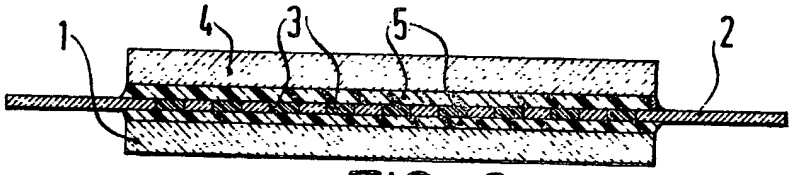


FIG. 3

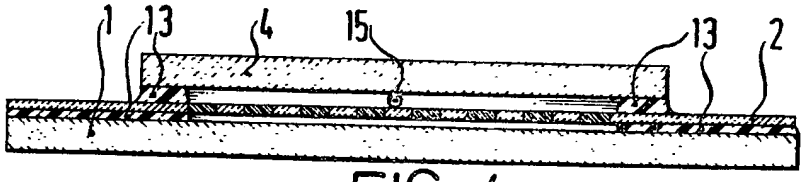


FIG. 4

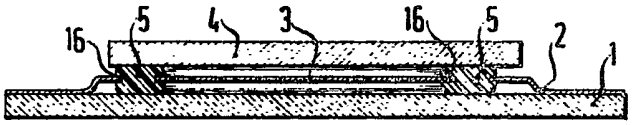
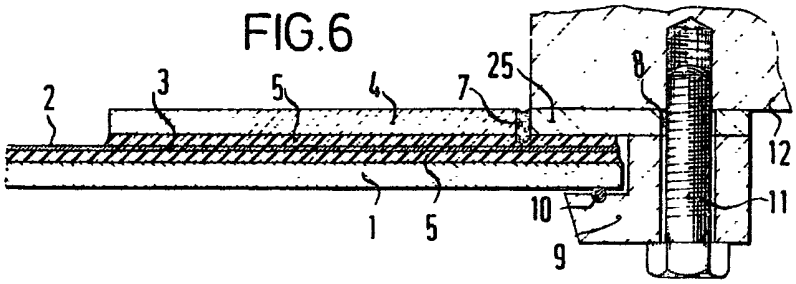


FIG.5

FIG.6



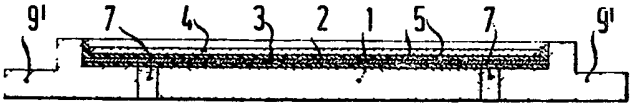
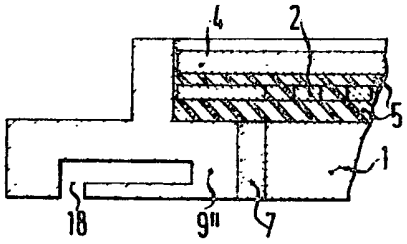


FIG.7

FIG.8



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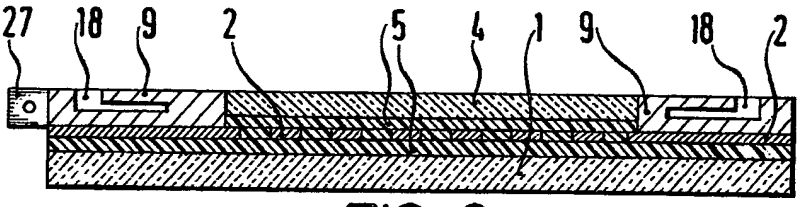


FIG. 8

FIG. 9

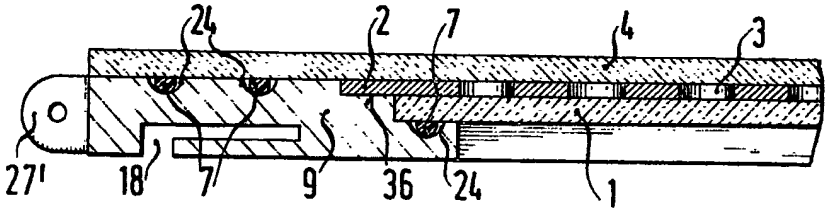


FIG. 10

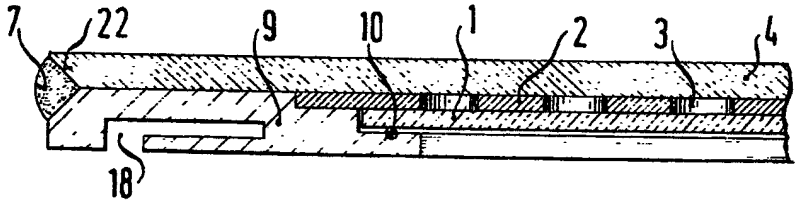


FIG. 11

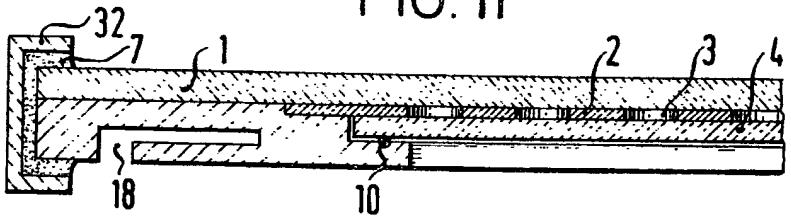


FIG. 12

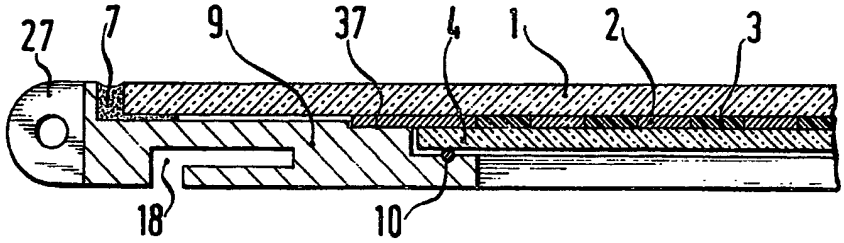


FIG. 13

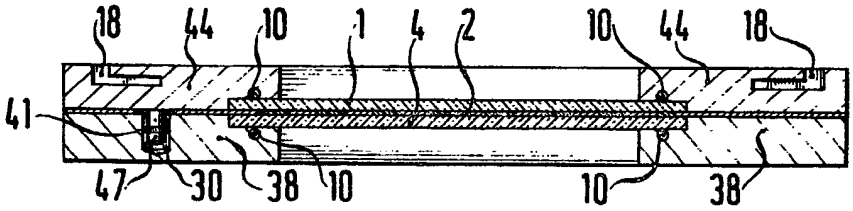
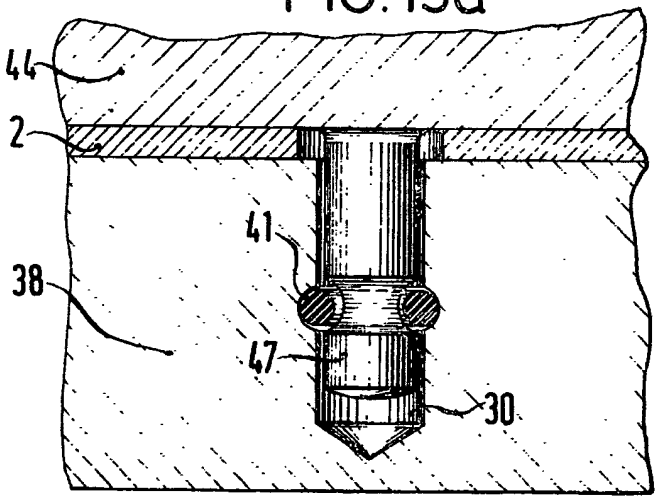


FIG. 13a



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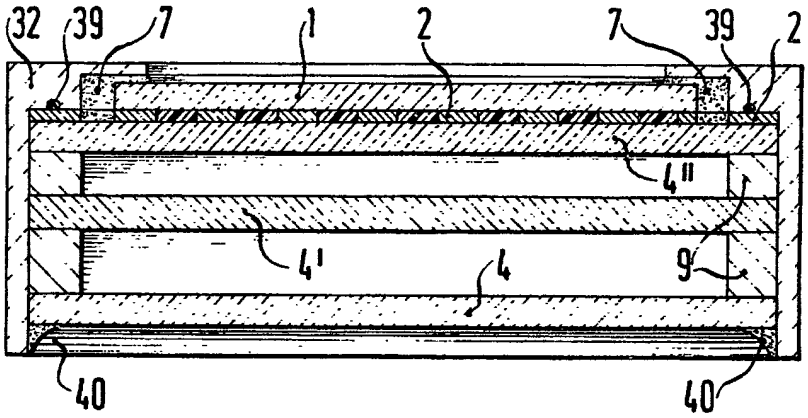

FIG. 14

SPECIFICATION

Glass and/ r vitreous c ramic laminate system f r microwave- hi lding applicati ns

The invention relates to glass-and vitreous ceramic laminate systems for application as protective screens in respect of microwave radiation comprising an integrated metallic microwave shield, the systems being preferably partially transparent and thus at the same time allowing visual observation of the interior spaces which are charged with microwaves.

It is known in the art to provide windows and doors for microwave-charged spaces which are made up from two or more discretely arranged sheets of glass or plastics material and which comprise a microwave shield in the form of a fine-mesh wire net or metal foil or -sheet with a suitable perforation grid arranged between two of said sheets. The windows and doors for domestic microwave ovens, for example, are constructed on this known principle. Their component parts are combined with auxiliary elements such as a spacer and tensioning frame, in such a way that no microwave radiation can escape from the oven interiors to the outside. Such windows or doors can be dismantled into their original component parts by releasing the threaded or other fastener means for the auxiliary elements.

Also known are laminate glass windows which however in the generally applied form have no microwave shielding properties. In the simplest case such composite windows consist of two glass panes which are bonded together by their mutually facing sides by means of a transparent intermediate layer of a viscous plastics adhesive. The plastics layer may consist of a suitable adhesive foil or of resins which are introduced jointly with a hardener into the gap between the panes. Composite glass panes of this type are used, for instance, as safety windows in vehicles.

Multiple-laminate sheets made up of many alternately arranged layers of glass and plastics are used for burglar-and bullet proofing applications as well as in aircraft construction.

Also known are laminated glasses with wire-mesh inserts where fine metal wires are embedded in the intermediate layer of plastics material which are used, for example, for the purpose of electrically heating the glass panes or which may also be included in a burglar-alarm circuit. Composite or laminate glasses with embedded metal wires of this type are not in th known form suitable for application as microwav scr ens.

Also known ar wire-reinforced glass s which comprise a r lativ ly wide-meshed metal wir grid or netting embedded dir ctly in the glass by fusion. Again this type f glass known as "wir glass" is not suitable for microwave-screening purpos s.

Finally, there are known techniques or methods of connecting glass or vitreous ceramic plates which are mutually bonded by m ans of p rman ntly elastic adhesives to frames or appropriate securing elements.

The above mentioned known microwave-screen windows or doors according to the state of the art have a number of drawbacks; the metal wire mesh or the metal screen foil or sheet which represents the microwave shield is fitted as a discrete component between at least two sheets or panes which must be sufficiently thick to provide adequate mechanical strengh. It is typical, for example, to use two toughened float-glass panes of 4 to 5mm thickness. This leads to undesirably heavy weights for the window assembly as a whole and has the disadvantage that, for such an arrangement, specially designed heavy frame constructions are needed in which, at unduly high cost, are individually fitted and sealed the glass panes between which—potentially with the aid of additional spacer frames or -pieces—the actual shielding means such as fine wire mesh, perforated foils or sheets, must be mechanically removably secured in a geometrically precisely determined position to satisfy the demands of effective microwave shielding with sufficient overlap and/pressure fit relative to the metal parts of the frame construction. Another disadvantage resides in that the view through observation panels with microwave shield according to the above described state of the art is impaired by light diffusion effects caused by the perforated metal foil or by the wire mesh or by the perforated screen plate. This effect renders the window less optically transparent than would be expected from the actual area coverage of the metallic screen means relative to the whole window area.

The invention aims to provide observation panels or windows for microwave-charged spaces or chambers, which combine good optical transparency and low weight with maximum microwave shielding and which, being rigidly bonded units, are very largely fracture-proof and, if desired, equipped with means for quick and easy mounting, being preferably already non-detachably connected to a frame element, and which, according to special embodiments of the invention, are also suitable for application to microwave-charged chambers which are at the same time subjected to high temperatures. These windows are further designed to provide a high degree of safety in respect of microwave emission in the event of fracture.

According to the present inv ntion there is pr vided a glass-and/or vitreous ceramic laminat system comprising, between at l ast two plates of glass and/or vitr ous ceramic material, a metallic shield which is impervious to microwaves and permanently bonded t said

plates by means of a visc usly lastic and/or perman ntly lastic adhesiv , and wherein the said metalli shield is conducted ut of th bonded unit in such a manner as to enabl it being conn cted in micr wave-s al d manner, in use, with an adjoining metallic fram and/ or mounting means.

The effective microwave shield may consist of a perforated metallic foil, of suitably fine wire mesh or of a printed screen produced by printing on one of the two panes using a metallic preparation such as for example conductive silver which is then fixed on the pane by baking. Preferably the said laminate unit is also adhesively bonded to frames which are suitably adapted to given installation conditions for the observation windows in the microwave-charged chambers.

In a first embodiment of the invention the observation window is fabricated as a laminar bonded unit, the two panes of the unit being bonded together by a transparent viscously elastic layer of plastics material in which is embedded the metallic microwave-shield which latter, in accordance with microwave-shielding requirements, projects all round beyond the laminar unit by a sufficiently wide margin to enable all round electrical contact with the walls of the microwave chamber.

According to a second embodiment of the invention which is particularly designed for application at high temperatures, the observation window consists of plates or panes of a borosilcate glass or of a vitreous ceramic material having small thermal linear expansion which are adhesively bonded only along their marginal edges to one another and to the microwave shield by means of permanently elastic silicone rubber adhesives to form a bonded unit. In this arrangement the layer thickness of the silicone adhesive will be chosen in such a manner as to ensure compensation in respect of different linear expansion between the panes and the microwave shield (metal foil or wire mesh) by elastic deformation of the silicone adhesive.

In further development of the invention, corresponding to an envisaged application, the above described units or observation windows are adhesively bonded to metal and/or plastic frames which frames may at the same time serve as means for the fabrication of the bonded units of this type, thus achieving the production of ready-to-fit window or door-units with microwave shield.

If adhesively bonded frames cannot be used in a given application, frames with means for clamping-fixation of the window units with int grated microwave shield will be used instead.

Th inventi n is h reinaft r more particularly described in th f llowing Examples with reference t th accompanying drawings in which Figs. 1 t 14 ar sectional views of various embodiments f the laminate system according to th pr sent invention.

Example 1:

Fig. 1 is a sectional view of a bond d window unit with microwav shield according to a first mbodim nt (In this and th following figures, the layer thickness of the intermediate plastic layer is shown disproportionately enlarged for clearer representation. According to the state of the art it is generally very thin, for example typically 0.1 mm on either side of the metallic microwave shield). The microwave shield 2, which may consist for example of a thin aluminium foil in which a perforation grid or raster has been produced by punching or etching, is placed on top of the supporting plate or pane 1 and covered with a glass cover plate or pane 4 of which the lengths of the lateral edges are less than the corresponding edge-lengths of the supporting plate 1. This leaves a free, uncovered margin all round the periphery of the microwave shield foil the width of which is adapted to the demands of microwave-screening purposes. The shield foil 2 may be contacted in this marginal region with the metallic frame parts of the window (not shown in Fig. 1) or it may overlap these parts with a very narrow gap to the required width. The supporting plate 1, the microwave shield 2 and the glass cover plates 4 are adhesively bonded in laminar fashion by means of a viscously elastic layer of plastic adhesive 5, the perforations 3 of the shield being completely filled with the plastic adhesive. Due to the immersion effect of the plastics material 5 which completely fills the holes 3 in the microwave shield foil, the transparency of the bonded unit is significantly improved by comparison with conventional windows, which corresponds to the inventive aim of achieving "improved transparency", because the diffusing or scatter-influence of the perforated foil is cut out. The construction of the viewing window in the form of a bonded laminated unit with implanted metallic microwave shield allows considerable weight savings up to 50% by comparison with conventional window constructions because the unit can be manufactured with plates or panes of preferably 1.5 to 2 mm thickness. Moreover, the adhesive bonding provides safety for the units, that is to say, in case of destruction the broken pieces are retained in the unit. In the event of fracture the microwave shield effect is effectively preserved for as long as the shield foil remains intact, i.e. is not pierced. Furthermore as stated in the description, the bonded unit offers advantages in respect f ass mbly or installation because it can be fitted in corresponding apertures without probl ms and saf ly in the same manner as a simple glass pane. Microwave-leakage mission—as may occasi nally ccur with conventional bserva- tion windows due to faulty installation or

assembly is avoided by reason of the fact that the bonded units according to the invention can only be fitted in one constructionally predefined way.

Example 2

In another embodiment of the invention, the shielding properties of the unit in regard to microwaves are achieved due to the fact that, instead of providing a metal shield foil 2 as shown in Fig. 1, a suitable metallic raster or grid of conductive silver or another metallic preparation is printed and baked on one of the two plates or panes. Such a unit is shown in Fig. 2. For example, a screen pattern or grid 2 with holes 3, is printed in, for example conductive silver, on the supporting plate 1 and fixed by baking, which adopts the microwave-shield function. The supporting plate 1 with the microwave shield printed and baked on, is adhesively bonded to the cover plate 4 by means of a transparent layer of plastics bonding material 5. In all other respects this unit corresponds to the unit according to example 1.

Since in the event of fracture of the supporting plate 1 with the printed grid screen 2 the effective microwave-shield would no longer be guaranteed because the printed screen would then be broken in many places, metallic conductor strips 6 are baked on to the exterior side of the supporting plate, said conductor strips 6 being branched in an auxiliary circuit which cuts out the microwave source in the event of a break in conductor strips 6 and prevents the apparatus from being switched on again with a broken plate.

Example 3

It is also possible, instead of the metallic screen foil 2 (Fig. 1) specified in connection with example 1, to arrange between two outer plates a third plate or pane provided with a printed and baked-in screen pattern of conductor silver or another suitable metal preparation for microwave-shielding, the outer plates being bonded over the whole surface area thereof the central plate which carries the printed screen by means of a transparent viscously elastic plastic adhesive to form a laminated unit. The special properties of the bonded unit described with reference to example 1 are also achieved with this kind of arrangement.

Example 4

In modification of the embodiment of the invention according to example 1 (Fig. 1), the bonded unit may also be fabricated in such a way that the metallic shield foil 2 with the screen or raster 3 of the unit projects beyond the supporting plate 1 and the cover plate 4, as shown in Fig. 3. Again the adhesive bonding of plates 1 and 4 to the shield foil 2 is made by a transparent plastic bonding material 5 applied over the whole surface area of the parts so that the special properties of the unit described in example 1 are also obtained with this embodiment.

For the production of the bonded laminate units with microwave shield described in examples 1 to 4 a liquid resin/hardener mixture is applied to the supporting plate 1, evenly spread out and, for example, the shield foil with perforated screen 2 (Fig. 1) is allowed to sink into this adhesive layer so that the holes 3 in the foil are completely filled by the resin/hardener mixture. Immediately afterwards the screen foil is evenly coated with resin/hardener mixture whereupon the cover plate 4 (Fig. 1) is lowered onto the covered foil. The resulting composite unit or laminate is then hardened with pressure application at temperatures between 60°C and 200°C which ensures that the component parts of the unit achieve firm overall surface bonding with one another.

The chosen resin/hardener mixtures must be of a type which retains viscous elasticity after setting so as to be able to compensate for differential thermal expansion of the two glasses and the microwave shield when the unit is subjected to heat.

The laminates so far described are not suitable for application at high temperatures because the intermediate layers of plastics material cannot withstand temperatures of for example 250°C. In modification of the bonded units with microwave shielding effect described in examples 1 to 4 we shall now describe composite units which can be safely used in temperatures up to 300°C. These units dispense deliberately with whole-area bonding and with the immersion effect of the intervening layer of plastics material and are instead adhesively bonded together only along their marginal edges with the aid of a permanently elastic silicone rubber.

Example 5

An embodiment of an observation window with microwave shield for application in spaces which are charged with high temperatures and with microwaves is shown in Fig. 4. The microwaves screen foil consisting of metal, or a suitable wire mesh or a perforated sheet 2 is adhesively fixed along the marginal edges on a supporting plate 1 of borosilicate glass, vitreous ceramic or toughened float glass with the aid of a permanently elastic silicone rubber compound 3. By means of the same silicone rubber 3 a cover plate 4 of borosilicate glass, vitreous ceramic or toughened float glass is adhesively fixed on this arrangement along the marginal edge thereof. Between the plates 1 and 4 and the shield foil 2 there is air for which pressure equalisation relative to the exterior can be assured by the hole 15 in the adhesive seam or joint. Differences in length expansion which occur be-

twe n plates 1 and 4 and the metallic microwav shield 2 when th unit is subjected to heat will b compensated by the d formati n of the permanently elastic silic ne rubber which must be applied in a layer thickness on each sid f th microwav shi ld f no less than 1.5 mm. For the purpose of heat ray-reflection, the supporting plate—if serving as the outside pane in the unit—may be provided with heat-refelective coatings, for example with SnO_2-coatings.

Example 6

Another method of adhesively bonding the unit to the microwave shield in an observation window designed for application at high temperature is shown in Fig. 5. Here the coverplate 4, the microwave shield 2 and the supporting plate 1 are bonded together through or across the perforation grid 3 or through corresponding additionally provided perforations 16 in the microwave shield with a plurality of silicone rubber-bonding points 5 in one single operative step to form a bonded unit.

According to a further development of the invention the bonded units described in the foregoing examples and shown in Figs. 1 to 5 are equipped with suitable frames to make up complete window-panel units which are ready to be fitted as microwave-proof observation panels or doors with viewing panels to close microwave ovens or chambers. Essentially all these examples are confined to application of units of the kind shown in Figs. 1, 4 and 5. However the same kind of arrangement may also be sensibly adapted to application of other types of bonded units.

Example 7

Fig. 6 shows a microwave-shielding window which is adapted to be placed over openings in the walls of microwave-charged chambers using a bonded units of the kind shown in Fig. 1. The bonded unit with microwave shield comprises the supporting plate 1, the screen foil 2 and the cover plate 4 which are laminated together by means of a transparent layer of plastics material 5, and it is adhesively fixed to a metal flange 25 by means of an electrically conductive, permanently elastic adhesive 7. This flange is provided with holes 8. The flange 25 with a metal frame 9 which overlaps the supporting plate 1 of the unit and caries a circumferentially continuous sealing bead of rubber 10 is firmly applied in microwave-proof manner to the walls of the microwave chamber by means of screws 11 screwed into the hamber walls 12.

Example 8.

In anoth r mb diment of the unit according to Fig. 7 the metal fram 9 is used at the sam tim for the fabrication of the bonded unit as such: a first window pan , or plate 1, corresponding t the above described glass cover plate, is s aled by means of silicone rubb r 7 in a metal frame 9. In this manner a kind f mould is formed into which is then poured a resin/hardener compound 5 wh reupon the shield foil 2 is dropped into this compound and, following a further application of resin/hardener compound 5, the supporting plate is placed thereon. After curing of the resin/hardener compound 5 at temperatures between 60°C and 200°C a bonded unit with microwave-shield according to Fig. 1 is obtained which together with the frame 9 represents a ready to fit unit and may be mounted, for example by means of screws as a detachable window panel applied externally to the wall of a microwave-chamber or it may be used as basic component for a door. In the later case a $\lambda^0/_4$ bag will be provided by way of microwave barrier 18 in the metal frame 9 as shown in detail in Fig. 7a.

Example 9.

Figs. 8 to 12 inclusive show various options of making glass-doors with microwave shield using units of the type according to example 1 and Fig. 1, which may be used with advantage, for example as doors for microwave ovens designed for domestic use.

The cross sectional representation in Fig. 8 shows a door of which the metal frame 9 with the microwave trap or $\lambda^0/_4$-bag 18 is welded or electrically conductingly adhesively bonded to and forms a unit with the shield foil 2. This unit is adhesively bonded over the whole area thereof by means of a resin/hardener compound 5 to a supporting plate 1 which preferably consists of a 4 mm thick toughened sheet of float glass. In the same manner a thin float glass panel 4 is adhesively bonded by means of a resin hardener compound in the window opening of frame 9 so that a bonded unit with microwave shield according to example 1 or Fig. 1 is obtained on which a frame 9 is adhesively fitted and which may be attached with the aid of hinges 27 to serve as a door for the housing of a domestic microwave oven.

In the case of the door with microwave shield shown sectionally in Fig. 9, a finished unit of the kind described in example 1 is bonded in three circumferential positions by permanently elastic adhesive 7 to a metal frame 9 which is provided with a continuous circumferential microwave trap 18 and with mounting hinges 27. To this end the frame 9 is provided with circumferential grooves 24 or depressions into which the adhesive is injected lik a continuous beading whil it is still in a plastic state.

The bonded unit, in which the supp rting plate pr ferably consists of 4 mm thick hardned float glass, is then pressed on the frame 9 to which the adhesiv 7 has been applied and by this operation the metallic shi ld foil 2

of th unit is automatically brought into electrical contact with the metal fram 9 in the r gion indicated at 36 in Fig. 9.

In anoth r embodiment shown sectionally in Fig. 10, the bond d unit is fix d by a permanently lastic adhesiv 7 in a circumferential groove 22 of a metal frame 9 with microwave-trap 18. A circumferentially continuous silicon-rubber sealing bead 10 on the inner edge of the frame provides the required seal and support for the bonded unit.

Fig. 11 shows another method of adhesive bonding whereby a door element with microwave shield is also obtained by a combination of a bonded unit according to example 1 with a metal frame. The completed bonded unit is clipped on the narrow side to the metal frame 9 which is provided with a continuous circumferential microwave tralp 18 or $\lambda^0/_4$ bag by means of a circumferential decorative metal frame 32 and further secured allround by application of a permanently elastic bonding adhesive 7.

Fig. 12, finally, shows a door with microwave shield which can be produced in a very simple and inexpensive manner due to the appropriate design of the metal frame and dispensation with whole-area contact bonding of the plates in the units.

On a metal frame 9 with continuous circumferential microwave trap 18 and hinges 27 a first thin sheet of float glass 4 is placed on the provided support with rubber sealing bead 10 and the microwave screen 2 is adhesively fixed with sufficient overlap in the groove 37. The 4 mm thick hardened plate 1 is then placed thereontop and bonded to frame 9 along the marginal edge by permanently elastic silicone rubber 7. By using borosilicate glass plates or vitreous ceramic plates as well as a suitable adhesive instead of the described float glass, this door assembly may be adapted for application at high temperatures up to 300°C.

Example 10

A door for domestic microwave ovens using a bonded unit according to example 3 and as shown in Fig. 3 is shown in section in Fig. 13, and in detail representation in Fig. 13a. On top of the fiished bonded unit comprising plates 1 and 4 and a shield foil 2 which overlaps the plate edges on all sides thus providing a broad contacting area is placed a continuous metal profile surround 44 with $\lambda^0/_4$ bags 18 and sealing bead 10. This profile is fitted with self-locating clips 47 (see Fig. 13a) extending through holes in the screen foil 2 and when a second profile 38 of metal or plastics material with s aling b ad 10 is pressed thereontop, engaging in corresponding holes 30 and locating means 41 in said second profile 38. In this way a rigid fram is obtain d in which th bond d unit comprising plates 1 and 4 and shi ld foil 2 is set, the shield foil b ing electrically contacted with the frame profile 44 by virtue of the clips 47.

Example 11.

Th last example (Fig. 14) is a multi-plate unit for the doors of chambers in which microwaves and high temperatures are applied, such as for example domestic ovens.

A first plate 1 consisting of borosilicate glass or of vitreous ceramic material is fixed by means of a temperature resistant permanently elastic adhesive 7 in a metal frame 32. The microwave shield 2 is placed on top of this plate and pressed together with plates 4, 4′ and 4″ and a spacer frame 9 against the seat 39. This causes the still soft and generously applied adhesive 7 to penetrate through the holes in the microwave shield 2 and to locate the latter. The assembled plate unit is held together by a circumferential adhesive seam 40 and clamped fast by means of a suitable clamping device until this seam 40 has completely hardened. The supporting or engagement faces 40 enable the multi-plate unit with microwave shield being clipped or screwed to the remaining metallic parts of the door in microwave-sealed manner.

All of the illustrated and described examples relate to plane plates. Naturally corresponding arrangements may also be produced with curved or differently shaped plates of any desired configuration up to double cylinders.

CLAIMS

1. According to the present invention there is provided a glass-and/or vitreous ceramic laminate system comprising, between at least two plates of glass and/or vitreous ceramic material, a metallic shield which is impervious to microwaves and permanently bonded to said plates by means of a viscously elastic and/or permanently elastic adhesive, and wherein the said metallic shield is conducted out of the bonded unit in such a manner as to enable it being connected in microwave-sealed manner, in use, with an adjoining metallic frame and/or mounting means.

2. A system according to claim 1, wherein the metallic microwave screen is a thin perforated screen foil whose resolution is determined by the respectively envisaged operative wavelength.

3. A system according to claim 1, wherein the metallic microwave shield is a fine wire mesh in which the mesh aperture is determined by the envisaged operative wavelength.

4. A system according to claim 1, wherein th microwav shi ld consists of a screen form d by printing a metal preparation on one of the two plates of th bond d unit and fixing it thereon by baking.

5. A system according to claims 1 to 4, wherin the plat in th unit which is provid d with the printed and baked-in metallic screen

is provided on its opposite side with like wise printed and baked-in conductor strips which, in association with an auxiliary electric circuit, adopt the safety function for the microwave chamber by preventing its operation in the event of window breakage.

6. A system according to claim 1, wherein one or both of the plates are provided with electrically conducting transparent coatings for microwave shielding.

7. A system according to any preceding claim, wherein the plates in the composite unit are bonded in laminar fashion to one another and to the microwave shield by means of a transparent, viscously elastic plastics material.

8. A system according to claims 1 to 5, wherein the two plates of the unit and the microwave shield are mutually bonded along their marginal edges by means of a permanently elastic adhesive with openings or spaces being left in the adhesive seam for ventilation of the space between the plates and pressure equalization of the space between the plates and pressure equalization when the unit is subjected to heat.

9. A system accrding to claim 1, 7 or 8, wherein the microwave shield projects beyond the two plates of the composite unit on all sides thereof by a width which corresponds to the respectively applicable demands of effective microwave shielding.

10. A system according to any of claims 1 to 3, wherein the microwave shield, in addition to the screen, is provided along the marginal edge thereof with larger holes or slits through which a permanently elastic adhesive is applied to one of the two plates so that when the second plate is pressed thereon both plates and the microwave shield are welded and fixed together in one single operation.

11. A system according to any of claims 1, 3, 6 and 7 wherein a metal flange is bonded by means of an electrically conductive adhesive to the supporting plate with shield foil laminated thereto, said flange being further adhesively fixed to plate by a permanently elastic adhesive and secured to the exterior wall of the microwave chamber by an overlapping frame and screws extending through bores in flange.

12. A method of making a composite system according to any of claims 1 to 3, 6 and 7, wherein a metallic frame serves at the same time as a mould for making the composite unit, a first plate being adhesively fixed in said metallic frame by means of permanently elastic adhesive and the shield foil as well as the supporting plate being laminarly fixed in the resulting mould by means of a permanently elastic adhesive applied over the whole area of corresponding sides thereof whereupon the unit is cured at temperatures of 60°C to 200°C.

13. A system according to any of claims 1, 3, 6 and 7, wherein the bonded unit is adapted to serve as a door for microwave chambers due to the fact that a metallic frame which is provided with a peripheral microwave foil is welded or electrically conductingly bonded to a shield foil and that this unit is laminated by means of a resin/hardener mixture to a plate 1, and in that a second plate is laminarly bonded in the frame aperture by means of resin/hardener mixture and that the metallic frame is provided with mounting hinges.

14. A system according to any of Figs. 1, 3, 6, 7 and 13, wherein a finished unit is adhesively fixed using permanently elastic adhesive at three peripheral positons with a metal frame having a peripheral microwave foil, whereby the metallic frame is provided with peripheral grooves which at the same time serve for dosage of the adhesive means.

15. A system according to any of claims 1 to 7 and 13, wherein a finished unit, is adhesively fixed all round to the groove-shaped narrow side of the metallic frame by means of a permanently elastic adhesive.

16. A system according to any of claims 1 to 7 and 13, wherein the finished bonded unit is combined, with the aid of a narrow decorative trim frame extending around the narrow side, with the metal frame which comprises the microwave trap, the trim frame being additionally bonded to the unit and to the metallic frame by means of permanently elastic adhesive.

17. A method of making a composite system according to any of claims 1, 8 and 13, wherein a thin pane of float glass is placed on a metallic frame with a surrounding microwave trap, the glass pane being placed on the provided support with sealing bead and the microwave shield being adhesively fixed with adequate ovelap in the rebate of the metallic frame, with the cover plate being placed thereon and bonded at the edges to the metallic frame 9 by means of permanently elastic adhesive 7.

18. A system according to claims 1, 9 and 13, characterised in that a finished bonded unit in which the marginal edge of the microwave shield foil overlaps the plates all round as shown in Fig. 13 rests on a metal frame 44 with surrounding microwave trap 18 and sealing bead 10, the frame 44 being equipped with self-locating clips 47 which engage through corresponding holes in the shield foil 2 in further holes 30 provided in a second frame 38 made of metal or plastics, in that the said second frame 38 also carries a surrounding bead 10 and by virtue of the clamped connection of the two frames 44, 38, the shield foil 2 of the bonded unit makes contact with frame 44 through the clips 47.

19. A method of making a bonded system according to any of claims 1, 8 and 10,

wherein a laminate unit with microwav shield is produced for application to chamb rs which are subjected to microwave radiation and also to high temperatures by applicati n of th perati nal steps comprising th adhesive bonding of a borosilicat glass-or vitre us ceramic plate in a metallic frame by means of a heat resistant permanently elastic adhesive, then placing the microwave shield thereon and pressing it, together with further plates, and a spacer frame, firmly on the seat provided in the metallic frame, the applied pressure causing the adhesive to penetrate through the holes or slits which are formed in the shield foil so as to locate and at the same time adhesively bond the same to one of the further plates, and applying a surrounding permanently elastic adhesive seam along the end of the metallic frame for cohesion of the bonded unit to the first mentioned plate.

20. A system according to claim 1, substantially as hereinbefore described with reference to any one of Figs. 1 to 14 of the accompanying drawings.

CLAIMS (23 Nov 1983)

Claim 6 deleted. Appendency of remaining Claims corrected.

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